N° 15,404 A.D. 1912

Date of Application, 2nd July, 1912—Accepted, 26th June, 1913

COMPLETE SPECIFICATION.

Improvements in Storage Batteries.

I, EDWARD SOKAL, Chemist, of 2841, Michigan Boulevard, Chicago, County of Cook, State of Illinois, United States of America, do hereby declare the nature of my said invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in storage batteries and particularly to a method for conveying the electrolyte under pressure through the electrodes and using hollow elements which are disposed and arranged so as to completely or partly surround each other.

Storage batteries in which the electrolyte is forcibly conducted through the electrodes in a continuous cycle are known. It is also known to reverse at periodical intervals the direction in which the electrolyte is conveyed through the elements. This reversion of the flow of the electrolyte sometimes took place by means of reservoirs, in which the electrolyte was being stored after having been conveyed through the battery in one direction, the electrolyte from the reservoir then being discharged in the opposite direction through the battery. It has also been attempted to attain a reversal of the electrolyte by means of circulating devices without reservoir.

I have found that the most suitable arrangement for pressure batteries can be obtained by constructing the electrodes in form of hollow or partly hollow elements whereby the length of the edge to be secured against seepage of the liquid is greatly reduced. If one electrode is placed entirely or partly within another hollow electrode the necessity of packing a large number of long edges is avoided. I am aware that it has been proposed to construct the electrodes in the form of cylindrical plates, the cylinders being open at the bottom and at the top. This arrangement would facilitate the interposition of a plurality of electrodes with respect to each other without, however, decreasing to a very material extent the length of the edge which must be packed against the other electrodes or against the vessel.

My invention, therefore, consists primarily in the combination of hollow or partly hollow electrodes in pressure batteries in such arrangement that a plurality of these hollow electrodes are interposed with respect to each other, so that the length of the edge which is to be secured against leakage is materially decreased.

The interposition of these electrodes in the manner stated also results in the advantage that by means of a single conveying device, like a pump, or such like, and without the utilization of reservoirs, a liquid may be forced through the walls of a large number of electrodes and that the periodical reversal of the direction of flow may be effected in the easiest possible way.

Storage pressure batteries usually contained a plurality of hollow electrodes which were juxtaposed similar to the arrangement of the electrodes in ordinary storage batteries. The battery described in the following embodies the additional improvement, that several electrodes surround other electrodes partly or completely, in order to utilize the inner surfaces as well as the outer surface of these hollow electrodes.

Fig. 1 is a section through an element of a storage battery.

[Price 8d.]

Fig. 2 is a vertical section through a modification of an element of a storage battery of this kind.

Fig. 3 is a horizontal section through the modification shown in Fig. 2, and

Fig. 4 is a section and partly an elevation of an element of a storage battery wherein the circulation of the electrolyte is produced by means of a plunger piston.

Figure 4ª is a view on which the peculiar action of the pump in the raised position of the piston may be clearly seen.

Fig. 1 illustrates a battery comprising a receptacle 1, which is provided with a cover 2, to effect a gas-tight closure of the receptacle. A tubing 3 extends from the cover 2, and is in communication with the interior of the receptacle; this tubing is also connected with the pump. The pump serves for forcibly conveying the electrolyte from the hollow of the innermost electrode through the other electrodes into a compartment 6, disposed between the wall of the receptacle 1, and the outermost electrode. A tubing 7 may serve for conveying electrolyte from the compartment 6 back into the tubing 3.

The pressure may be caused to act to convey the electrolyte in opposite direction, so that the electrolyte from the compartment 6 is forced through the electrodes in direction towards the innermost electrode.

The electrodes 9 in Fig. 1 are shown to be of cylindrical shape, and are set one into the other so that the inner surface of the largest electrode is in opposition to the outer surface of the next and so on. They are separated from each other by porous cells 10, which are provided with bottoms 11, and which allow the electrolyte to pass successively through all of the electrodes. The cells 10 being in engagement with the surface of the electrodes, serve as support for the active mass of the same, and the electrodes, therefore, may be made relatively thin. Fig. 1 shows the electrodes as consisting of perforated sheet metal 5, the active mass 12 being held on both sides of each electrode by means of the perforations after it has been applied in moist condition, and after it has been compressed therein.

In the form shown in Figure 2 the portion 21 of the positive electrode is made hollow so as to receive the negative electrode plate 22. In a very similar way the negative electrode 24 is hollow to receive a positive electrode plate 26. The electrode elements of the same polarity are connected by metallic rods 23 and 25 respectively, which extend through insulating bushings in the hollow electrodes. It will be seen that part of the positive electrode is enclosed in negative electrode, while part of the negative electrode is enclosed in the positive electrode. It is obvious therefrom, that on account of this arrangement, the inner surface of the electrodes, as well as the other surface thereof, is rendered active. To secure the electrode plates in the interior of the hollow electrodes, insulating blocks may be provided (which are not shown in the drawing) and which will bridge the space between the two electrodes of different polarity.

The electrodes shown in the third modification, Fig. 4, resemble in their general construction the electrodes 9, of the modification shown in Fig. 1. They are also separated from each other by porous elements 10. Each electrode constitutes a receptacle which is closed at the top by means of some insulating plate and which is also insulated from the adjacent electrodes by interposed annular elements 27 of hard rubber or such like. The circulation device in this modification comprises a plunger piston 28 which is driven by some suitable means, not shown in the drawing, and which is adapted in its operation to force the electrolyte from the innermost electrode radially through the other electrodes. The plunger is slidable in an enlarged extension 29 of the innermost electrode 30 and in the raising movement of the piston an annular interspace 31 will be produced between the piston and said extension, as shown in Fig. 4ª. The electrolyte will flow through this annular space, returning thereby to those portions of the elements upon which the pressure is exerted during the pressure periods.

In Fig. 4 the piston 28 is shown in its middle position. When this piston is lowered it forces the electrolyte through the electrodes to the battery, an operation which is common in all pumps that are provided with pistons. If the piston 28 goes up higher than the position in which it is shown in Fig. 4, the flaring flange 29 will allow the electrolyte from the outside of the hollow electrodes to rush through the interspace 31 between this flange and the piston.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A storage battery wherein the electrolyte is forcibly conducted through the electrodes by means of a pump, or such like, including a plurality of hollow or partly hollow electrodes which are entirely or partly interposed with respect to each other, or inserted one into the other.

2. A storage battery, as set forth in Claim 1, wherein the electrolyte is forcibly conducted from the innermost hollow electrode through the outer hollow electrodes, and *vice versa*.

3. A storage battery, substantially as described and shown and for the purpose set forth.

Dated this 1st day of July, 1912.

JOHN LIDDLE,
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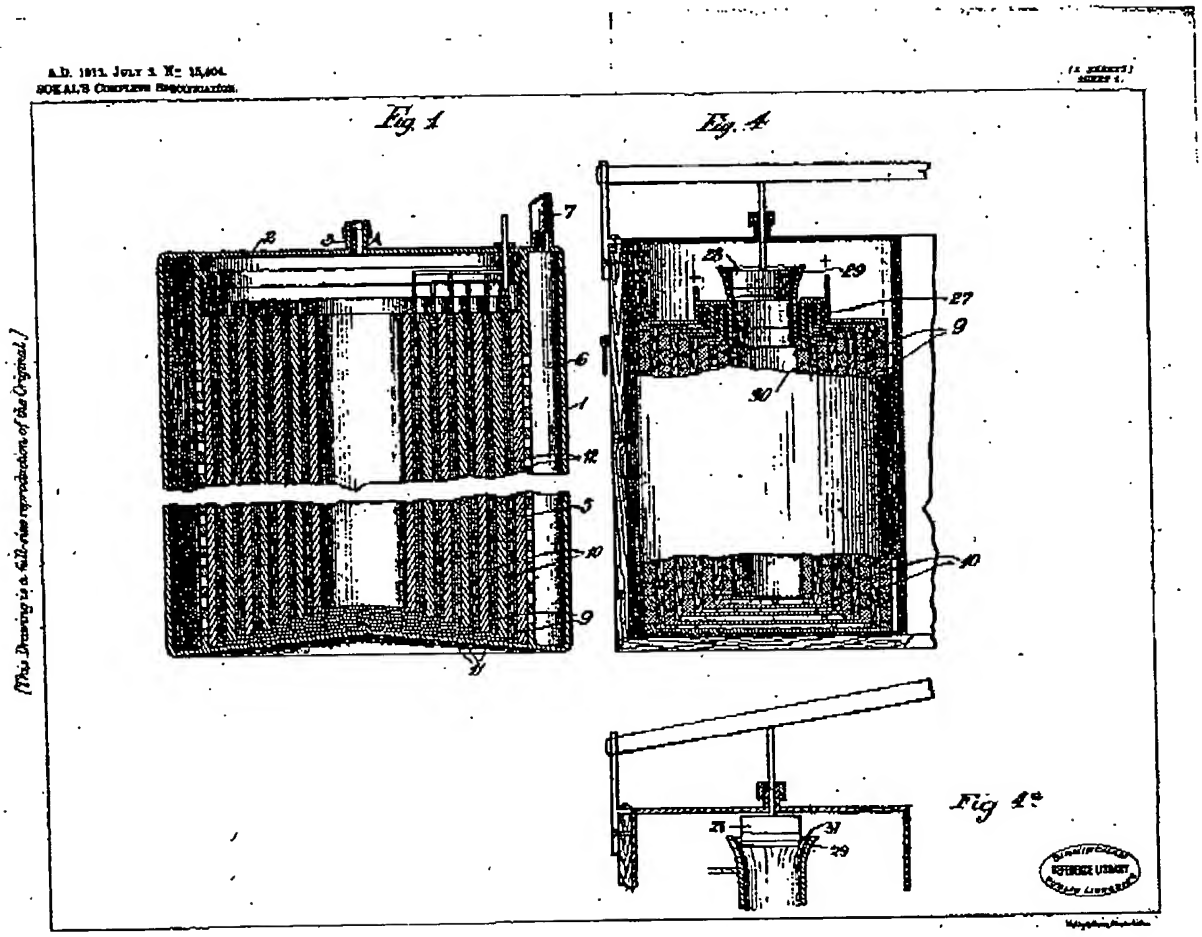
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SOCIAL'S Complete Specification.
Fig. 1
Fig. 4
Fig. 4a
[This Drawing is a full-size reproduction of the Original.]

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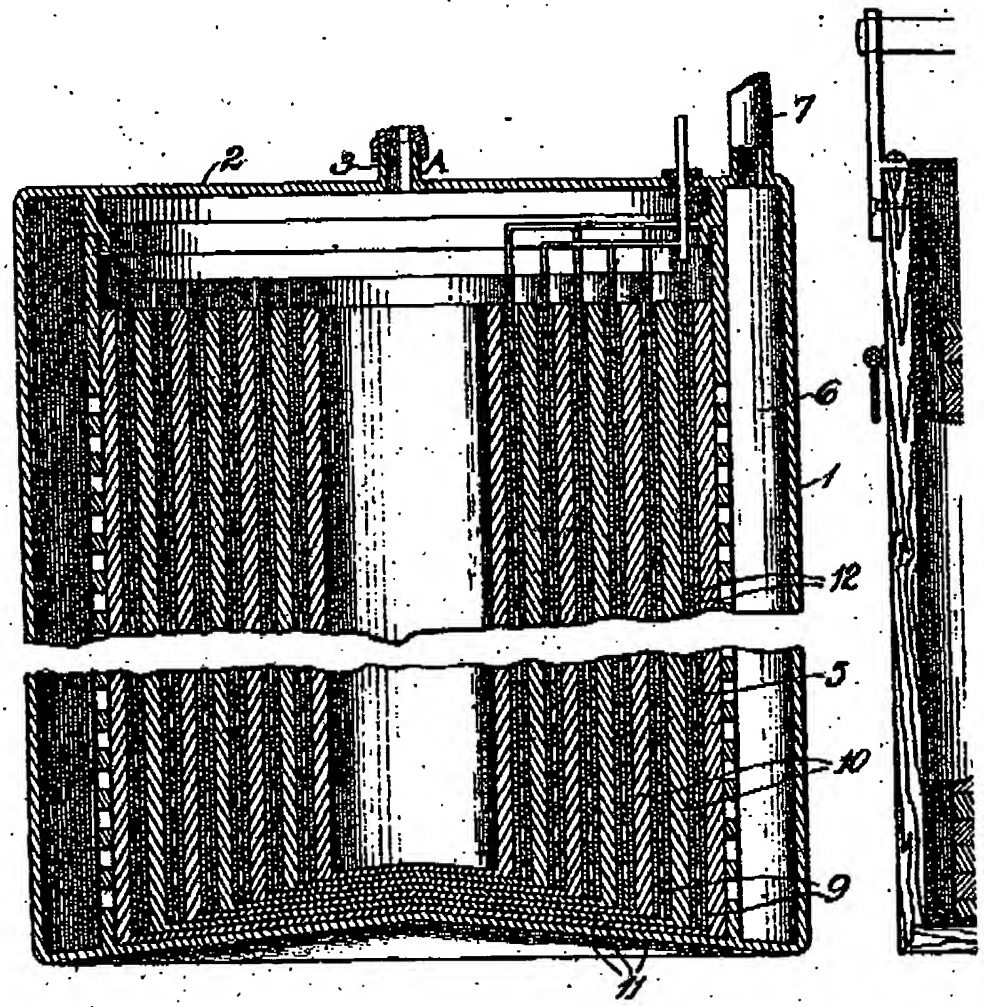
SOKAL'S COMPLETE SPECIFICATION.

Fig. 1



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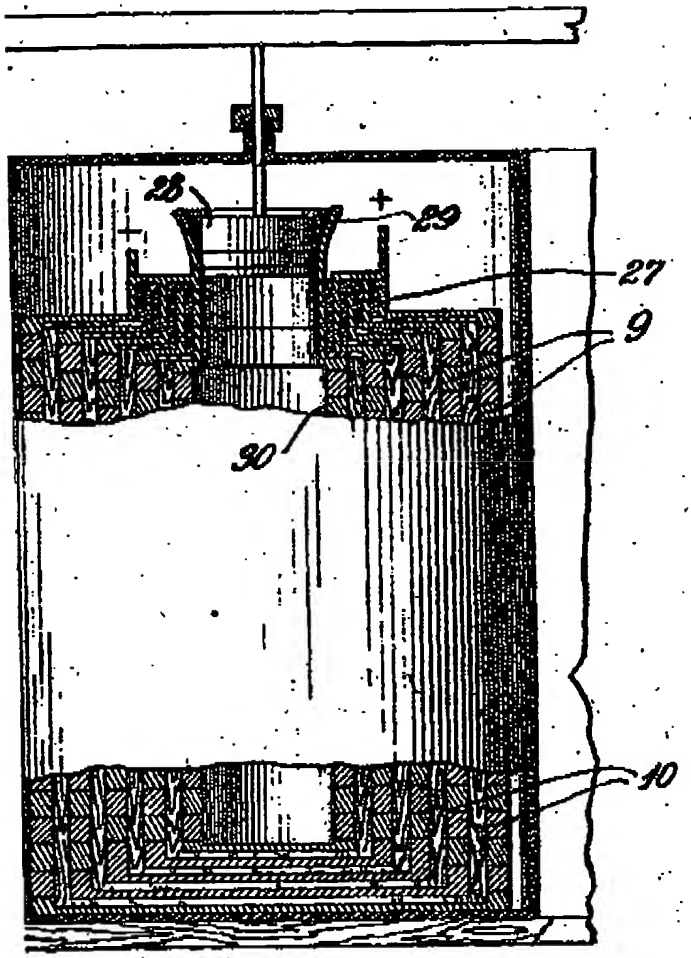
(2 SHEETS)
SHEET 1.

Fig. 4.



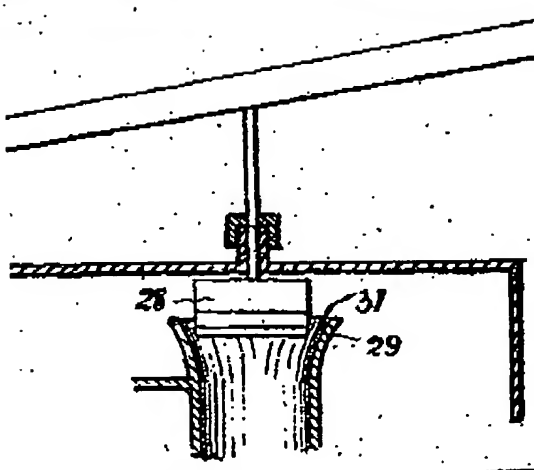
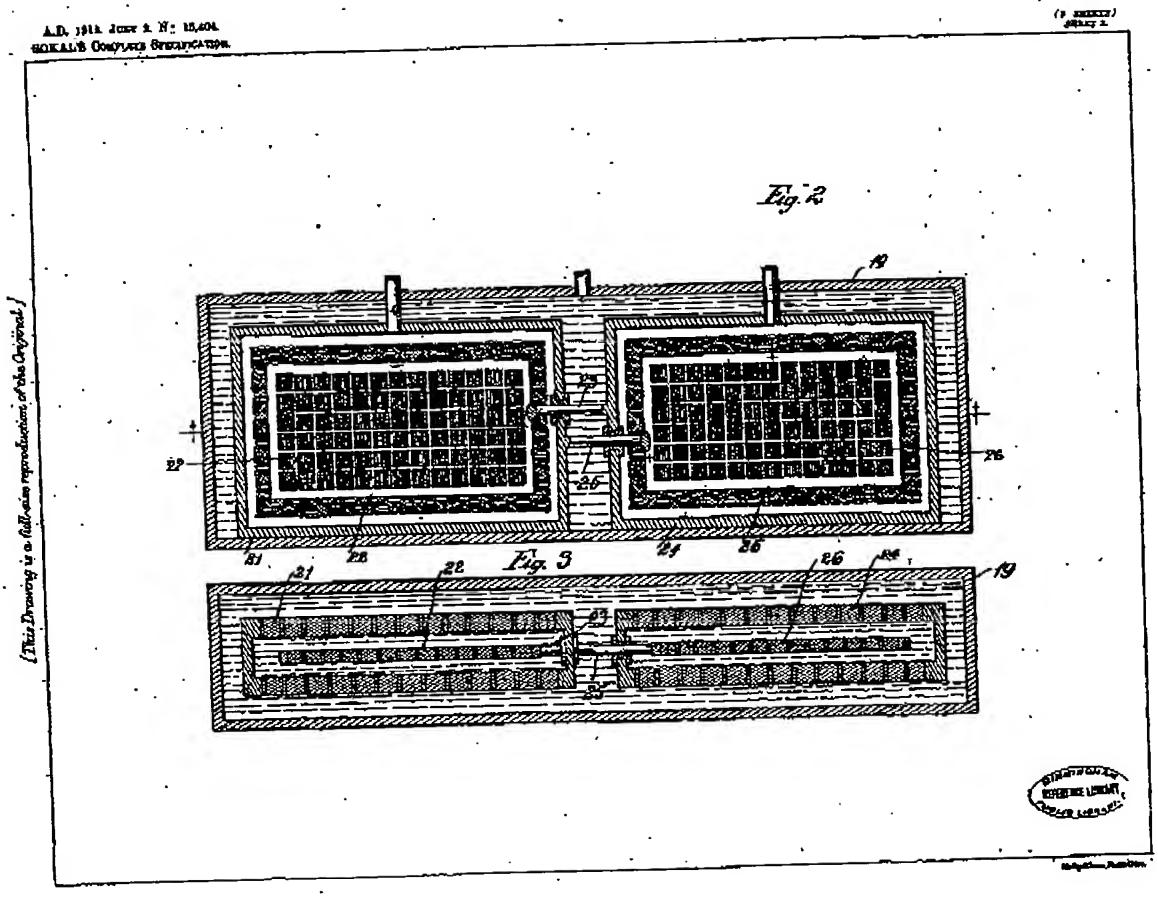


Fig 4a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GOKALP'S COMPLEX SPECIFICATION.
[This Drawing is a full-size reproduction of the Original.]
Fig. 2
Fig. 3

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SOKAL'S COMPLETE SPECIFICATION.

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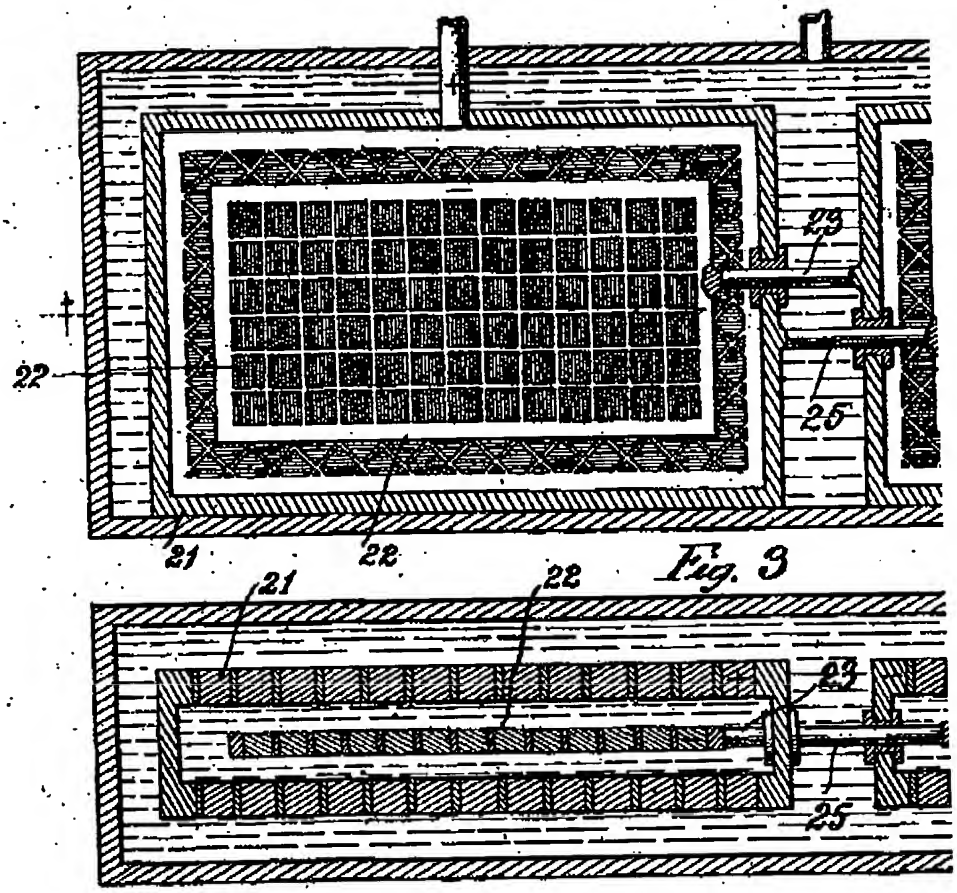

Fig. 3

Fig. 2